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The Asia Science Letter is a quarterly publication of the Asian Office of Aerospace Research and Development (AOARD), Detachment 2 of the US Air Force Office of Scientific Research (AFOSR), the basic research manager of the Air Force Research Laboratory (AFRL). Its purpose is to inform the Air Force S&T community on the research and development activities in Asia and Pacific Rim countries including India and Australia. The assessments in this periodical are solely those of the authors and do not necessarily reflect official US Government, US Air Force, or AFOSR positions.

Highlights

An historic first meeting of the Viet Nam – U.S. Joint Intergovernmental Committee on Science, Technology Cooperation took place 14-16 November 2001, with Dr. Brett Pokines of AOARD representing the DoD. Dr. Norman Neureiter, S&T Advisor to the Secretary of State, organized this meeting to explore possibilities for S&T interaction between the U.S. and Vietnam.

Japan is a world leader in new battery technology. Limitations in battery capacity and life are critical factors in improving mobile electronics, transportation, and other applications. However, as the energy capacity of the conventional Li-ion battery approaches the theoretical upper limit, new technologies must be explored. This month's feature article by Dr. Miyazaki explores the area of fuel cell technology.

Recent AOARD visitors included Dr. Art Guenther (University of New Mexico), Dr. Patrick Mason (AFRL/HEDR), Dr. Darrell Hopper (AFRL/HEC) and Major Todd Heinle (manager, AFRL Spatial Disorientation Countermeasures Program).

The following photo shows Professor Alan MacDiarmid (Nobel Laureate from the University of Pennsylvania), following his Invited talk at the AOARD sponsored 2nd Chitose International Forum on Nanotechnology (CIF'2) in September. With Professor MacDiarmid are Professor Naoya Ogata (President, Chitose Institute of Science & Technology[CIST]), Professor Koike (Invited speaker from Keio University), and a student from CIST.

Terence J. Lyons, M.D., M.P.H.
Director



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Features

Fuel Cells for Portable and Wireless Devices

Next Generation portable and wireless devices will include equipment capable of color displays, speech recognition, and embedded MP3 sound playback. Future development of wireless devices includes applications such as location-based services, e-banking and personal information management. These devices will demand a significant increase in their battery's capacity and life, while coping with exponential increases in performance. Current trends of dramatically increasing microprocessor frequency and hard disk memory density and diversification of interface specifications, maximum peak power consumption in portable PCs is estimated to exceed 100W. Currently, the energy capacity value of the conventional Li-ion battery appears to approach the theoretical upper limit. Fortunately, new technology, in the form of fuel cells, has been developed to replace conventional secondary batteries. Fuel cells are considered complex batteries, but clean, electric power generators. Theoretical fuel cell energy capacity is over ten times that of a Li-ion battery, with energy densities projected to be more than 10,000 Wh/l and 1,000 Wh/kg. Fuel cells are now under development for practical use in co-generation systems in industrial factories, automotive power sources and housing systems. There are still unsolved cost problems in both the production and maintenance phases; however fuel cells show great promise if some additional technological barriers can be overcome for usage in portable equipment:

? Novel high quality electrolyte film must be synthesized for use with the direct methanol method. Conventional Nafion® of DuPont is apt to generate crossover phenomena of methanol. Sony Inc. has selected C60 fullerene composite instead of Nafion®. They have achieved a maximum methanol concentration of 50% (limited value) and confirmed operation down to -20 degree C and a start-up time of less than 1 second. Hitachi Ltd. has also developed a new electrolyte film and reduced crossover phenomena to one-tenth.

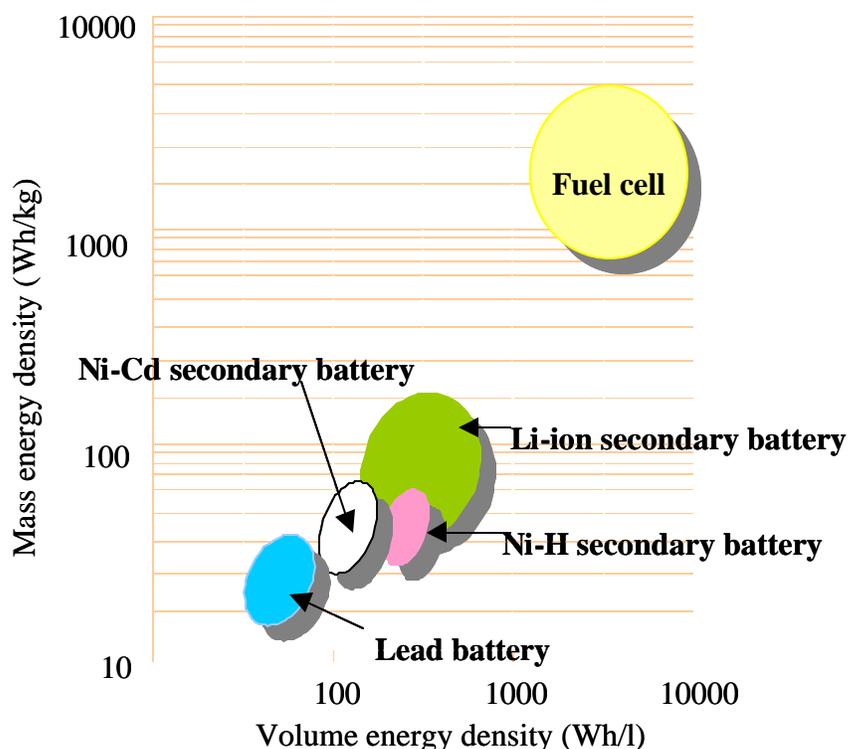
? Improvement in generation efficiency of H⁺ ion, must scale down catalytic Pt particle size to 2 nm. NEC Inc. fabricated composite materials of carbon nanohorns and Pt Fuel cell output power improved 20%.

? Direct use of methanol is the common approach for a fuel source. However, Prof. Suda of Kogakuin University developed a new boron-hydride fuel and achieved output voltage of 1.64 V (cf. 1.24 V for methanol fuel).

? Honda Inc. and Stanford University have collaborated on a new fuel cell system. It consists of a series connection structure of multiple cells collocated over Si substrate of 10 cm diameter, on which small gas flow paths were formed by MEMS technology. Specifications of the new cell are output voltage of 1.5 V, current density of 100 mA/cm² and generation efficiency of above 40 %. Hitachi developed a new capillary fuel supply method and achieved a 2.4V output.

Several years from now, continuing efforts in novel fuel cell design will allow PC notebook computers to be operated continuously for over 60 hours and Personal Handyphone Systems (PHSs) to be recharged once a month. While not perpetual motion machines, what more could be asked for?

For another interesting view on this and related topics, see the trip report from a recent visit to Japan by Geoffrey Prentice. Special Scientific Report #01-02 (August 28, 2001) "Electrochemical Phenomena and Catalysis Research in Japan" is available on the [NSF Tokyo Webpage](#) [1]: (Miyazaki)



(NIKKEI ELECTRONICS 2001 10.22)

AOARD Scientist Visits Vietnam

Meeting: The First Meeting of Viet Nam – U.S. Joint Intergovernmental Committee on Science, Technology Cooperation, Hanoi, 14-16 November 2001. A delegation headed by Dr. Norman Neureiter, Science & Technology Advisor to the Secretary of State Colin Powell, and consisting of representatives from the Department of Defense (Dr. Pokines of AOARD), Department of Energy, Department of State, National Institute of Health, National Oceanographic & Atmospheric Administration, National Science Foundation, and the Office of Naval Research met with representatives of the Vietnamese government to discuss further science & technology interaction between the U.S. and Vietnam as outlined by the Agreement on Scientific & Technological Cooperation signed between the Socialist Republic of Vietnam and the United States of America one year earlier. Scientific exchange, interests, methods of support, and committee procedures were addressed. Working groups related to public health, energy, information & communication technology, fisheries, environment, hydrology and agriculture provided an opportunity to focus on topics of immediate interest to Vietnam. Dr. Chu Hao, Vice Minister - Ministry of Science, Technology and Environment, the Vietnamese delegation leader identified areas of future interest and development such as telecommunications, information technology, bio-science, and materials research. Dr. Chu Hao also discussed the challenge of promoting basic research in Vietnam and the desire to expand basic research efforts and refine the basic research management system. The planned outcomes of these efforts are a more highly skilled workforce and increased science or technology content in all commercial products. The meeting also included site visits to the National Center of National Science and Technology (NCST), Hanoi University of Technology, and the Institute for Machinery and Industrial Instruments. NCST was featured in an ASL 32 article. NCST is the premier basic research laboratory in Vietnam, consisting of seventeen institutes. Hanoi University of Technology was established in 1956 with missions including education, technology transfer, and the growth and establishment of commercial ventures. The university generates 4 million U.S. dollars per year in commercial product revenue. Technology priority areas identified by the university representatives included information & telecommunication technology (e.g. parallel computing), bio-science (e.g. gene research), materials development (e.g. nano-materials), and environmental development (e.g. solid & liquid waste remediation). While current technology levels vary in these areas, they echo planned growth areas (e.g. information & communication technology) and historical technology focus (e.g. waste remediation) in Vietnam. The Institute for Machinery and Industrial Technology is primarily a training center. International expansion plans through the establishment of branch offices to increase commercial revenue and technology transfer were presented. A potential area of specialization and development includes water-jet cutting. In summary, each site visited exhibited a commercial mission to generate revenue, a need for infrastructure investment (and in some cases evidence of new infrastructure investment), and active international visitation and outreach (e.g. Europe). (Pokines)

Aerospace & Mechanical

News: Airships in Japan. Dr Phil Koenig, of the Office of Naval Research-International Field Office-Asia, recently authored a report on current [airship developments \[2\]](#) and a recent [airship workshop \[3\]](#) in Japan; they can be found on the ONR-IFO web page.

Conference: 2001 International Robot Exhibition, Tokyo, 13-16 Nov: Even though perhaps not as big as previous years, the 2001 show was still an exciting place to view the latest developments in robots. While aimed primarily at the industrial market, entertainment and service robots were also on display.

Autonomous robots were well represented. The Institute of Agricultural Machinery of the Bio-oriented Technology Research Advancement Institution (BRAIN), presented tractors capable of autonomously working fields. Bigger audiences were attracted to the companies showing off dancing and other cute robots intended for mass consumption such as the PC programmable oversized beetle called a [WonderBorg \[4\]](#) or the small humanoid robot from [Fujitsu \[5\]](#). The Nonami Lab at Chiba University had their recent walking [land-mine clearing robot \[6\]](#) on display.

The Japan Atomic Energy Research Institute sponsored development of a “Remote Surveillance Squad” to deal with nuclear emergencies. Three basic robot types were developed: 1) small light robots to collect information for initial situational awareness 2) a robot with a single manipulator for more detailed information collection, and 3) a sample return robot with two manipulators. At the show, six robots were demonstrated by their creating companies: Hitachi, Toshiba, Mitsubishi Heavy Industries, and Nissho-Iwai. Go view the AVI files of a [Hitachi robot in action \[7\]](#), if interested.

Inter-robot communication remained an important topic at this year’s show. JARA, the Japan Robot Association is the vehicle for two communications developments. Industrial robot users are developing the Open Robot Interface for the Network (ORiN) standard to link dissimilar robots. On the consumer front, the JARA Entertainment Robot Forum members developed RoboLink, a wireless protocol. At the show, toys danced in unison, but the application to general purpose household service robots is likely not far in the future.

On the more experimental side, the National Institute of Advanced Industrial Science and Technology presented their Modular Transformer robot which is able to transform from a [crawling to a walking robot \[8\]](#). A number of universities were also showing their wares; see their web [university websites \[9\]](#) for more information. (Mikami, Nowack)

Workshop: 3rd RACE Colloquium – Collaboration Engineering, University of Tokyo, 30 Oct 2001. Research into Artifacts, Center for Engineering (RACE) was established in 1992, based on a proposal by Dr. Yoshikawa (a former President of the University of Tokyo and now a Chairman of Japan Science Council). The center consists of three main research fields: Design Science, Manufacturing Science and Intelligence Science. The objective of RACE is to establish a new discipline for the design and manufacturing of artifacts, and to clarify the use and recycling of the manufactured artifacts. RACE includes six laboratories and is conducting a number of research projects such as knowledge systemization, intelligence CAD, material design, 3D model compression and robot control. RACE has held colloquia hitherto in relation to Life Cycle Engineering, Engineering on Digital Values and so on.

This year, Collaboration Engineering was a main topic (13 lectures and talks). Highlights included;

New values obtained through a linkage of data of the highest quality and their innovative customization (Dr. Villars and Prof. Iwata, MPDS and Univ. of Tokyo). In the fields of material technology, biotechnology and landscape design technology, usability of sharing database was exemplified with various data. Among them, the Linus Pauling File (LPF) design system was explained in detail. It will be commercially available next year. Creation of artifacts based on bio-paradigms (Prof. Takahashi, University of Tokyo). The usefulness of studying bio-mimetics was made clear in the fields of neural network, agent system, genetic algorithms and so on. Creation of novel artifacts will next turn toward self-restoration and self-growth. The final goal is the creation of artifacts exceeding the capabilities of the original organism. For further information, refer to the [RACE colloquium website \[10\]](#) or [e-mail them \[11\]](#). (Miyazaki)

Conference: The Japan Society for Aeronautical and Space Sciences (JSASS), Gifu Japan, 29-31 Oct. The 39th Aircraft Symposium was held by JSASS along with the AOARD-supported 15th English-language International Session and the 2nd Japan-Korean Aerospace Technology Symposium. As in previous years, the JSASS meeting covered a broad range of Japanese Aerospace technologies. A significant number of Korean aerospace papers were included this year as part of the Japan-Korea symposium, an annual event which alternates between Japan and Korea. The historically strong programs at Tohoku University and Nagoya University were represented with multiple papers, but academia, industry and government throughout Japan was well represented.

The most interesting hardware was a model for an electric fuel-cell powered airplane dubbed the “miracle vehicle”. Wings fold up during the ground transportation phase and the vehicle is driven on the road as a normal road-going vehicle. Specifications include: Length 4.45m; Wing-Span 6.0m open/2.25m (folded); Thrust 450 kg(f); Speed 200 km/h (air)/ 50 km/h (ground); Take-Off Roll 330m; endurance ? 4 hrs.



A half-day session was dedicated to “Self-Repairing Flight Control Systems” (SRFCS) with presentations by the Japan Defense Agency’s (JDA) Technical Research and Development Institute (TRDI) as well as the JDA Contractor, Mitsubishi Heavy Industries (MHI). Results were presented from dynamic wind tunnel tests conducted to evaluate the SRFCS ability to compensate for damage which occurred (battle inflicted damage, bird strike damage, Foreign Object Damage etc.) in flight.

Another interesting paper was a Cockpit Display System (CDS) which allows VFR flight under IFR conditions. The Japan Aircraft Development Corporation (JADC) is researching approaches to materialize the CDS for future aircraft. The CDS provides the information to pilots by an integrated, real-time, Synthetic Vision System (SVS) utilizing large displays which will make VFR-like operations possible in all flight phases under all weather conditions. Through multi-sensor fusion technology, the SVS provides a computer generated visual view of the external environment to the pilot such that it appears that there are no clouds, fog, rain, etc. (Sumrall, Nowack)



Cockpit Display Synthetic Vision System

Site Visit: School of Aerospace and Mechanical Engineering, University College, University of New South Wales, Canberra, Australia, 16 Oct 2001. AFOSR Commander, Col Steve Reznick and AOARD Technical Director, LtCol Mark Nowack, visited the academic arm of the Australian Defense Force Academy. Australia operates a single tri-service academy and the University of New South Wales is responsible for the traditional academic subjects. [UNSW \[12\]](#) is the largest Australian University, with four campuses in the Sydney area plus University College located at [ADFA \[13\]](#). The [School of Aerospace and Mechanical Engineering \[14\]](#) (AEMC) provides both undergraduate education to officer cadets as well as graduate education to military and civilian students. Its location near the Australian National University, leads to good cooperative research efforts between the schools.

Major research groups at AEMC include: Acoustics and Vibration, Design, Dynamics and Control, Fluids, Materials and Structures, and Naval Architecture. The strengths at AEMC reflect several Australian national strengths including: composite materials, design, aging aircraft, and super- and hypersonic flows and combustion. (Nowack)

Site Visit: Turbulence, Energy & Combustion (TEC) Group, Adelaide University, Australia 10 Oct 01. A joint venture between the Chemical and Mechanical Engineering Departments, the TEC is best known to the public for development of the fuel and combustion systems for the relay torches, community ceremonial cauldrons and the main stadium cauldron used in the Sydney Olympic Games. Their Focus is on understanding and controlling turbulence in combustion processes. Current applications include large industrial flames and co- and cross-flow combustion. A major effort is dedicated to the development of Planar Laser Polarisation Spectroscopy (PLPS) as a laser diagnostic technique in combustion. The technique allows for determination of two-dimensional distributions of a selected molecular species within a flame. Current work includes determination of the hydroxyl (OH) radical distribution in premixed CH₄/air and CH₄/O₂ flames. See their website for [further information \[15\]](#). (Nowack)

Conference: First International Symposium on Advanced Fluid Information (AFI-2001), Sendai, Japan, 4-5 Oct 2001.

The Institute of Fluid Science and Tohoku University have a long history of research and development in fluid sciences. Most of their past workshops and conferences have been conducted in Japanese so AFI-2001 provided a convenient look at work at the Institute and nearby NASDA and NAL facilities as well as the rest of Japan and the 12 other nations represented in the 158 conference papers. The conference aimed to bring together computational and experimental practitioners who deal with large-scale data analysis that results from studies of complex flow problems and quantitative field measurement techniques. Major session titles were: biofluids, boundary layer & transition to turbulence, plasma, multiphase flows, heat transfer & thermofluids, numerical methods, acoustics, plasma and electromagnetic fluids, shock waves, combustion, turbulence, and polymer & nano-scale phenomena. Ten half-day workshops were also conducted. The list of papers can be found at the [conference website \[16\]](#). Put AFI-2003 on your list of must-attend conferences. (Nowack)

Conference: The 4th IFAC Symposium on Intelligent Autonomous Vehicles, Sapporo, Japan; 5-7 September 2001.

This was the first [Intelligent Autonomous Vehicles \(IAV\) Symposium \[17\]](#) to be held in Asia. Technical areas discussed included control of multiple vehicles, vision, navigation, and man-machine interface/tele-operation. Applications discussed included aerospace, marine, agriculture, snowplowing, nursing, soccer, and intelligent transportation systems. (Lyons)

Site Visit: Mitsubishi Heavy Industries – Takasago Facility, 22 Aug 2001. While numerous robots exist to identify potential survivors in collapsed buildings, they are unable to precisely locate the survivors (at x_2 , y_2 , z_2 positions) because of their inability to enter into small areas. Therefore, microrobots are being investigated as a means of quickly locating the position and status of terrorist incident survivors.

MHI R&D Activities on robots originated from the automation of fuel exchange and inspection units for nuclear power plants approximately 20 years ago and has since expanded to other types of plant maintenance robots. The

company's applications now include thermal power plants, ships, and petrochemical plants, as well as nuclear power plants, and it is developing higher value-added ones to eliminate the need for humans to participate in the so-called 3-D work (dirty, dangerous, and difficult), i.e. manual labor near radiation from nuclear plants. R&D activities for these robots are principally conducted by the Takasago Research & Development Center of the Technical Headquarters, located about 60 km west of Osaka. Participating in the Research on the "Advanced Robot Technology" project promoted by MITI's Agency of Industrial Science and Technology, MHI Takasago R&D Center and Kobe Shipyard have jointly undertaken the most advanced R&D related to manipulation technology. As industrial structures undergo extensive changes worldwide and we enter into the era of increasingly older generations, the arena of robots is becoming increasingly important not only for facility maintenance but also for distribution, construction, leisure (entertainment), and welfare.

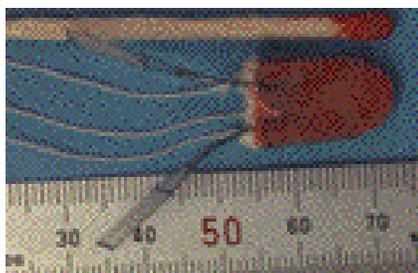
As micromachines become smaller, their traditional functional capabilities tend to degrade. Individual elements therefore have difficulty performing useful functions. One solution is the concept of "group or colony control" (based on system control). This concept involves the grouping of numerous individual units to accomplish a function that an individual microrobot unit can not perform alone.

To permit the construction and control these colonies, MHI has proposed a "holonic mechanism and form change control mechanism" and is in the process of carrying out basic research and development on this subject. The so-called holonic mechanism can develop different functions if identical elements or elements having the same kind functions (holon) are gathered in large numbers and mechanically assembled into a system.

The robot illustrated below (holonic mechanism) combines a large number of holons (round ones in the diagram). Each holon can only bend or turn, but a combination of many of the holons allows various three-dimensional forms and changing the form allows desired functionality to be added. This new mechanism has tremendous freedom that requires new control methods. The form change control method that gives several basic forms to the holonic mechanism (which is capable of having innumerable forms) controls only certain joints to limit the degree of freedom and realize the intended functions. This allows a micromachine to change form in accordance with functional requirements and adapt itself to various environments in a plant. This may permit such a design to become one of the most useful and innovative micromachines designed to date. (Sumrall)



Site visit: Kagawa University, Takamatsu, Japan, 21 August 2001. Kagawa University was visited due their work in the development of micro autonomous robotic systems. They have developed a flexible underwater (U/W) microrobot driven by a low voltage and showing good response. In this research, they demonstrated a new prototype model of an underwater microrobot utilizing an ICPF (Ionic Conducting Polymer Film) as the servo actuator. The U/W microrobot prototype has a “frog like shape” (due its pair of fins) and dimensions of 40mm length, 10mm width and 2mm thickness. Swimming speed may be controlled by changing the frequency of input voltage. The U/W robot is also capable of 3 dimensional swimming by controlling buoyancy. (See Figure) The U/W microrobot can also work on the surface as well as U/W with and without wiring. Without wiring for power, the microrobot can be propelled via a magnetic field. The Current Frequency changes the strength of the magnetic field. (Sumrall)



Underwater Microrobot

Site Visit: Denso Corporation, Nisshin City, Japan, 9 Aug 2001. Denso Corporation has developed a wireless miniature robot (funded by the Micromachine Center) which travels in a small diameter pipe at a speed of 10mm/sec. The robot is designed for the inspection of the inner surface of heat exchange tubes in power plants. Required functions include: wireless travel in a metal pipe, color photography of the inner surface of the pipe, and transmission of the image to an exterior monitor to permit crack detection.

The robot has a wireless data communication system capable of transmitting data at a rate of 2.5Mb/sec and wireless energy supply system of 480mW. The locomotion section is 66 mm in length, 9.5 mm in diameter with a weight of 7.3 g.

Additional devices, including a CCD camera; locomotive actuator; control circuit; wireless energy supply device; and RF circuit, are installed into small package with dimensions of 10mm in diameter and 50mm in length. Denso has overcome the traditional power supply problem by using a wireless energy supply system, a low power consumed actuator; high efficient energy conversion device, and power management system.

A non-wireless prototype was developed which can move within a curved pipe and capable of detecting pipe cracks with an eddy current sensor. With a diameter of 5.8 mm and an overall length of 20 mm, the miniature robot fits inside a 8 mm piping, and was inertia-driven. The prototype micromachine permitted the identification of problems unique to micro-technology. The biggest problems included the power supply wiring and signal monitoring. The subsequent wireless prototype added a CCD camera for inspection, an actuator for

locomotion, a communication circuit for control, and a microwave antenna and photovoltaic device for energy supply. (Sumrall)

Site Visit: Microrobot Research at The University of Nagoya, 8 Aug 2001. The University of Nagoya is considered a COE for microrobot R&D within Japan. Professor Toshio Fukuda is the most prominent professor at the University in the field of microrobots and is the head of the Micro System Laboratory. The Fukuda Laboratory organizes the International Symposium on Micromechatronics and Human Science regularly every year with the support by the City of Nagoya and other organizations (see ASL 33). The laboratory averages about 100 articles published annually, mostly in English in refereed journals. There are currently 26 major research projects; each project is associated with a Masters or PhD student. Some of the applicable projects are presented below:

? **Microrobotic System and Micromechatronics** This topic includes the analysis, the development and the control of microactuators, micro mobile robotic system and micromanipulators. Micro mobile robotics systems for use in a small pipe and micromanipulators with multi-degrees of freedom have been developed. Available silicon based microfabrication facilities including Chemical Vapor Deposition and Reactive Ion Etching equipment. The Micro Line Trace Robot and programmable Micro Autonomous robotic System (MARS) is also produced based on the support of these organizations.

? **Nanotechnology** The University of Nagoya is heavily involved in establishing the theoretical and practical applications for nanotechnology related engineering problems (based on analysis and synthesis from the micro level to the nano level). Areas under evaluation include: material fabrication; device machining; micro/nano manipulation; micro/nano measurement; micro/nano actuation; simulation; micro/nano robotics; and bio-medical science.

? **Optical Servo System.** The Fukuda Laboratory has studied an optical servo system using an optical actuator including an optical piezoelectric actuator (driven by an optical power supply). This actuator has potential for use as a communication device. Integrating these components will permit the development of an optical-electromechanical system. A prototype of an optical micro gripper and the optical mobile robot has been developed.

? **Image Processing for Bio-Engineering Technology.** The development of the image processing system for microrobots is the goal of this project. AI, fuzzy and neural network technologies are being applied for this project. Recognition of animal cells on a micro carrier along with the recognition of protoplasts for bio-engineering applications are the current research topics. (Sumrall)

Computation and Communication

Conference: Fifth Biannual Conference on Artificial Neural Networks and Expert Systems (ANNES'2001), University of Otago, Dunedin, New Zealand, 22-24 November 2001.

This is the last conference under the title that began in 1993 to bring together the researchers from the two communities, Soft Computing and Expert Systems. The major themes for this year's conference reflected the current trend in the areas of knowledge engineering and the information sciences. These included Adaptive Learning, Knowledge Discovery and Data Mining, and Intelligent systems for Communications. Along with a variety of papers presented by internationally recognized authors from different countries, the most recent work done in the [Knowledge Engineering Laboratory \[18\]](#), Department of Information Science, University of Otago was presented. The members of the University of Otago Emerging Research Theme "Connectionist-Based Information Systems Emerging Theme (CBIS/ET)," and research programme "Connectionist-Based Intelligent Information Systems (CBIIS)" presented their recent research results. The CBIS/ET is primarily concerned with advancing computational intelligence by developing and using generic methods, tools and systems, such as, neural networks, fuzzy logic inference mechanisms, evolutionary programming, chaos analysis, statistical methods, rule-based systems, methods for speech and image processing.

The keynote speaker, Prof. Takeshi Yamakawa (yamakawa@brain.kyutech.ac.jp) of Graduate School of Life Science and Systems Engineering, Kyushu Institute of Technology, introduced a new concept in neural network, called "Self-Organizing Relationship (SOR)" network, that can be applied to image enhancement, and controlling unknown systems. (Park)

Conference: The 2001 Asia Pacific Conferences on Web Intelligence (WI-2001) and Intelligent Agent Technology (IAT-2001, Maebashi, TERRSA, Maebashi City, Japan, 23-26 October 2001. The WI and IAT are biennial conference series, and they were jointly held this year. The objective of the joint conference is to provide an international forum for sharing original research results and practical development experiences among researchers and application developers. There were two keynote talks: one was jointly delivered by Prof. Edward A. Feigenbaum of Stanford University and AOARD, and Dr. James Hendler of University of Maryland titled "Knowledge is Power: The Semantic Web Vision," and another was by Prof. Benjamin W. Wah titled "Intelligent Agents for Market-Trend Prediction." The talk by Prof. Feigenbaum and Dr. Hendler suggested that, in order to reach the long-range goal of Web intelligence, artificial intelligence (AI) researchers' challenge is to create knowledge development tools that are usable by non-experts without a strong knowledge engineering background.

In the technical sessions, 53 regular and 85 short presentations were made covering:

- ?? Web Information System Environment and Foundation
- ?? Web Human-Media Engineering
- ?? Web Information Management
- ?? Web Information Retrieval
- ?? Web Agents
- ?? Web Mining and Farming
- ?? Web-Based Applications
- ?? Web-Based Active Contents
- ?? Advanced Topics and New Methodologies
- ?? Agent Computational Architecture and Infrastructure
- ?? Agent Learning and Adaptation
- ?? Knowledge Discovery and Data Mining Agents
- ?? Distributed Intelligence
- ?? Business Agent Solutions
- ?? Agent-Based Applications

Visit the conference website for [further information \[19\]](#) about these AOARD-supported conferences. (Park)

Symposium: Real World Computer 2001; TFT, Tokyo; Oct 3-5, 2001. The Real World Computing (RWC) project was initiated in 1992 as a ten-year national project under the support of METI. The objective is to development of innovative information processing systems and technologies capable of processing information in real-world situations. In the first phase from 1992 to 1996, fundamental and explorative R&D activities were conducted on the key parts of "Flexible Information Processing". From 1997, research resources were concentrated into two areas of "Real World Intelligence Technology", and "Parallel and Distributed Computing Technology".

Four sessions were held in this year's final round of the RWC project; Perspective of information society and information technology, Trends in high end computing, Adaptive devices and their industrial applications, and Overview of real world intelligence technology.

Highlights included:

A system for confirming novel functions has been established by using real world adaptive devices and intellectual resources for R&D. It consists of three sub-systems of multi-modal functions, autonomous learning functions and self-organizing information base functions. The useful software, "Cross Mediator" has been developed through this system and available practically.

Parallel and distributed processing technologies have been developed, which can provide an optimal parallel processing environment by dynamically configuring heterogeneous computing systems residing on a distributed system.

Optical interconnection technologies were also developed to achieve high speed transmission of a large amount of data between computers. Parallel systems which run efficiently in the parallel environment have been applied to computational chemistry and computational biology fields, and also large scale system areas. The Score system software was developed and evaluated to support the application developments in industries. RWC Score III consists of 1,024 processors and is the fastest self-mode cluster in the world as of June 2001.

Prof. Tanaka of University of Tokyo overviewed the whole project and concluded that future directions for fundamental technologies would be toward information integration and learning/self-organization.

For further information, contact [RWCP \[20\]](#). (Miyazaki)

Conference: 2001 URSI International Symposium on Signals, Systems, and Electronics (ISSSE'01), Tokyo, Japan, 24-27 July 2001: About 130 researchers participated in the triennial ISSSE which, for the first time ever, jointly represented Commissions C and D of the International Union of Radio Scientists (URSI). This was notably expressed in the subtitle, "Questing More Significant Harmony and Integration: Systems/Devices and Softwares/Hardwares." Historically, Commission C has represented signal-system and software-oriented technology; while Commission D covered device and hardware-oriented technology. Recently, however, the importance of cooperation between systems and devices – between software and hardware – is strongly recognized, where, in modern radio equipment, even single devices have complex system functions.

The symposium consisted of keynote speeches, focused, poster, tutorial, and regular sessions. In addition to the full spectrum of URSI Commissions C and D topics, ISSSE'01 included technical excursions to the nearby Yokosuka Research Park (YRP) and the NTT Yokosuka R&D Center. Also new and different: a notable keynote by R.J. Trew (Virginia Tech U.) drew attention to nanotechnology for next-generation electronics – that is, to keep electronic systems to Moore's Law – with a focus on nanotechnology enablers.

Its first time held in the Asia-Pacific region, ISSSE'01 was sponsored by URSI, the Electronics Society Communications Society (IEICE), the Science Council of Japan, IEEE Japan Council, and Tri-service supported by AOARD, ONRIFO-Asia, and ARO-Far East. (Maurice)

Electronics and Physics

Window-on-Science Visit: Prof. Sung-Ik Lee, Department of Physics, Pohang University of Science & Technology (POSTECH), Korea, 29 November 2001. Dr. Tae-Woo Park and his colleagues hosted Prof. Lee, the Director of National Creative Research Initiative Center for Superconductivity, at the Triservice. Prof. Lee presented a seminar entitled "High Current-Carrying Capability in c-Axis-Oriented Superconducting MgB₂ Thin Films." The research results by the Prof. Lee's team at POSTECH have been reported in the April 2001 Science journal as "the first and best superconducting MgB₂ thin film at 39K in the world." For further information, visit their [website \[21\]](#) or [e-mail \[22\]](#). AOARD can facilitate obtaining a sample POSTECH-made MgB₂ thin film for AFRL researchers for evaluation.

The abstract of the seminar is: "In high-quality c-axis-oriented MgB₂ thin films, we observed high critical current densities (J_c) of 16 MA/cm² at 15 K under self-fields. The extrapolated value

of J_c at 5 K was estimated to be 40 MA/cm². For a magnetic field of 5 T, a J_c of 0.1 MA/cm² was detected at 15 K, suggesting that this compound would be a very promising candidate for practical applications at high temperature and lower power consumption. The vortex-glass phase is considered to be a possible explanation for the observed high current-carrying capability. I will also discuss about the superconductivity of high density MgB₂ superconductor prepared in a synthesis condition of the artificial diamond. The properties of the single crystals will be also discussed." (Park)

Site Visit: Superconductivity Research Laboratory, Tamachi Laboratory, ISTE, Minato-ku, Tokyo, Japan; 9 November 2001. ISTE is one of the world's premier electronic-materials laboratories (URL <http://www.istec.or.jp/>). ISTE's Tamachi Laboratory houses its Division III and part of Division I under the leadership of Dr. Masato Murakami. ISTE's headquarters and main laboratory are located in Koto-ku in Tokyo, and smaller laboratories are located in Nagoya and Morioka. ISTE was established in 1988 as a nonprofit organization as part of a National Project on "Superconducting Materials and Devices" initiated by Japan's Ministry of Trade and Industry. It's original ten-year charter centered on basic research and development, including quest for new materials. ISTE's current-phase five-year mission focuses on research and development to support targeted applications. The four main areas of activity are development of next-generation wires and tapes, development of large high-quality bulk materials, development of new circuits and devices, and basic research. In addition to research and development activities, ISTE conducts technical and economic surveys, fosters educational outreach, sponsors conferences and workshops, and hosts various international collaborators. Highlights of recent results that were discussed included attainment at 77 K of a trapped magnetic field of 3.3 T in a Gd-Ba-Cu-O bulk sample, growth of high-quality MgB₂ single crystals, and enhancement in J_c(H) of MgB₂ through doping with Ti or Zr. Substitution of 10% of the Mg with Ti has increased the irreversibility field of bulk MgB₂ at 20 K to 3 T. This value is close to that required for many high-field superconductor applications. (Goretta)

Site Visit: Department of Superconductivity, University of Tokyo, Tokyo, Japan; 6 November 2001. The [Department of Superconductivity \[23\]](#) comprises 20 professors from the academic departments Applied Chemistry, Applied Physics, Electrical Engineering, and Electronics Engineering, their laboratories, several post docs, and dozens of graduate and undergraduate students. Research focuses on fundamental materials problems, including materials synthesis, growth of single crystals and films, microstructural characterization, measurement of physical, electrical, and magnetic properties, and analysis and modeling of various phenomena. The interests of those in the Department include all major classes of high-temperature superconductors, and the individual professors also study other electronic and magnetic materials and applications. Each professor's laboratory is very well equipped and, in general, self-contained. Materials under study can be made, characterized, and analyzed in house. The faculty in the Department collaborate extensively with researchers from around the world (Goretta)

Symposium: Femtosecond Technology – Open Forum; Komaba-eminence, Tokyo; 24 Oct 2001. Femtosecond Technology is a ten-year project funded under the Industrial Science and Technology Frontier Program of the Ministry of Economy, Trade and Industry (METI). In order to conduct the project, the joint R&D organization of the Femtosecond Technology Research Association (FESTA) was established in 1995 and advanced research themes have been pursued in cooperation with the National Institute of Advanced Industrial Science and Technology (AIST). Focus has been on two main themes:

1) Ultra fast optoelectronic device technology.

Ultra fast optoelectronic devices such as laser light sources and optical switches for terabit/sec communications systems are expected to be realized through R&D of ultra fast phenomena and ultra fine process technology.

?? Femtosecond light pulse generation and transmission technologies.

?? Femtosecond photonic node technologies.

?? Nanofabrication technologies for femtosecond photonic devices.

2) Ultrafast high brightness X-ray pulse generation and metrological technologies.

An ultra-fast high brightness X-ray beam will be generated by Thomson scattering of a femtosecond laser beam. A portable NDE system for diagnosing turbine blade failure will be realized with it.

This year's symposium overviewed R&D results during the first half of the project. Four invited lectures, eleven oral presentations and twenty-two poster presentations were provided to more than 300 attendees. Three highlights were included:

Short-pulse X-ray generation via Thomson scattering in 0- and 90-degree interaction (Dr. Sakai, Sumitomo Heavy Industries).

A compact high brightness X-ray generator was successfully developed. Obtained specifications were pulse width of less than 400 fs, beam energy of 2.3 KeV (5.2 Angstrom) and photon number of 10^4 photons/pulse (50 Hz). Applications to on-site diagnosis of turbines in power stations are under consideration.

High precision range finder by femtosecond laser (Dr. Minoshima, AIST). A newly developed range finder achieved 20 micro-meter error at the long range of 200 m (resolution of 10^{-7}) using a double color method to provide absolute measurement value. In the future, modulation frequencies of 10 GHz will give rise to high resolution value of less than 10 micro-meter.

Femtosecond optical pulse scope (Dr. Ogawa, FESTA).

Real time two dimensional image of ultrashort optical pulse wave form was provided, combined with two photon absorption and wavelength scanning of high speed rotating mirror. Maximum sensitivity of 10 pJ was obtained experimentally.

The next International Workshop on Femtosecond Technology (FES2002) will be held Jun 27-28, 2002 at AIST in Tsukuba, Japan. For further information, contact [FESTA \[24\]](#). (Miyazaki)

8th Microoptics Conference (MOC'01), Senri Life Center, Osaka, Japan, 24-26 October 2001: The biennial MOC met to update and review the status of microoptic technologies. These

included devices (lenses, filters, gratings and guides, lasers, and photodetectors), device enabling technologies, and technologies for communication systems, information processing, wavelength division multiplexing (WDM), imaging, and optical scanning and probing. Participation was down 1/3 from the previous MOC – in part due to the worldwide photonics slump -- with about 200 participants, most of which were from Japan, Korea, and Europe.

Always active at MOCs, groups under Prof. K. Iga (the Japan Society for the Promotion of Science) and affiliates presented a variety of VCSEL topics. Included were (i) work at Kogakuin U. in conjunction with Fujitsu on a unique optically pumped tunable surface emitting laser (GaInAsP/InP), promising for large continuous wavelength tuning. Changes in the VCSEL's resonant wavelength are induced by thickness gradients in the SiO₂/TiO epitaxial layers (thus changing cavity length). Also presented was (ii) work towards GaN-based blue lasers formed by separating the quantum well structures from their sapphire substrate by UV laser irradiation. Expanding out from their achievements in polymer-based plastic optical fiber, groups under Prof. Y. Koike's (Keio University and ERATO Koike Photonics Polymer Project) are developing specialized polymers for commercial applications. Their highly scattering optical transmission (HSOT) polymers were demonstrated for LCD backlight displays. An interesting poster paper showed fabrication of 3-D photonic crystals by holographic lithography (K. Ikemoto and Y. Ono, Ritsumeikan U., Japan).

MOC'01 was sponsored by the Japan Society of Applied Physics in cooperation with several academic societies and technical associations and Triservice supported by AROFE, AOARD, and ONRIFO-Asia. (Maurice)

Site Visit: Trekion Co, Ltd., Otsu, Japan (Tutomu Sada, Director). [Trekion \[25\]](#) and its' subsidiary Pionics Co., Ltd. test performance of new battery materials with flat cell, assists developing new battery materials, and conduct battery safety test as needle insertion, thermal stability and pressure breakage. Current research projects include miniaturization of power sources/batteries and as well as in minimizing environmental impacts. Pionics is currently developing new technologies for lithium polymer and lithium gel batteries. Other research area include photo-technology, for example, incorporation of NLO dyes into DNA films. (Lyons)

Site Visit: Physics at the University of Adelaide, Australia, 8 & 10 Oct 2001. Adelaide has a lot going on in space and atmospheric physics. The [Department of Physics and Mathematical Physics \[26\]](#) has a long history of using radar for upper atmospheric investigation possessing radar site in areas of relatively low radar clutter. As a result, members of the department also have relationships with researchers at AFRL/VS and AFOSR/NA. Also located at Adelaide is the Special Research Centre for the [Subatomic Structure of Matter and its Orion Supercomputer \[27\]](#). The AFOSR supported World Institute for Space Environment Research at Adelaide is hosting the [World Space Environment Forum \[28\]](#) in July 02. Adelaide also hosts the [National Institute for Theoretical Physics \[29\]](#) to bring together physicists throughout Australia. (Nowack)

Conference: International Narrow Gap Nitride Workshop (INGNW - 01), 7-11 Oct 01, Singapore. The INGNW-01 that convened in Singapore brought together almost 50 international experts in the theory, growth, characterization, and device applications of complex systems of nitride-based semiconductor alloys. Like others in its series, the focused-theme approach of this ONR Workshop identified and addressed the key science issues and applications to overcome “roadblocks” in the topic area; in this case, the important materials and device issues that will realize the potential of narrow bandgap nitrides. These are alloy systems such as InN, InGaN, InGaNAs and GaNAs, the most interesting compositions lying near or within a miscibility gap. Though complicating growth, metastable compositions can be grown and provide a rich set of phenomena where the metallurgical stability, in the presence of such thermodynamic limitations, and physical structure impact the subsequent electrical and optical properties. The formation of multinary compounds through the addition of N to GaAs or InGaAs can dramatically influence the electronic structure as well as the thermodynamic stability of these materials. For example, within the proper composition range, the alloys can exhibit extremely large bandgap bowing coefficients between the III-N and III-As or III-P binary compounds. A few percent of N into GaAs or InGaAs can reduce the energy bandgap to as low as 1eV. These complex alloys thus offer a wide range of new applications that include longer wavelength/visible diode lasers, optical detectors and waveguides, and highly efficient solar cells for power generation in space.

Topics of debate included materials synthesis, 1) epitaxial growth, 2) thermodynamic stability, phase separation during growth and subsequent thermal processing, and characterization and analysis with the incorporation of N, 3) doping control, 4) extended and point defects, 5) electronic structure including band offsets, and 6) novel device applications.

INGNW-01 was Triservice supported with Dr. Y.S. Park of ONR the POC. For program information and a few wrap-up points (courtesy of Prof. Charles Tu, UCSD) visit this [website \[30\]](#). (Maurice)

Conference: 28th International Symposium on Compound Semiconductors (ISCS'01), 1-4 Oct 2001, Tokyo, Japan. Almost 350 top researchers in compound semiconductors participated in this year's ISCS on the Komaba Campus of Tokyo University, a meeting that is preeminent in the field of III-V, II-VI, and IV-IV group semiconductors. Started in 1996 under the name of “International Symposium on GaAs and Related Compounds, the current name reflects its broadening of scope due to the now wide variety of compound semiconductor materials vital to modern electronic and optoelectronic devices. Material and device topics included magnetic materials and spintronics, nitride semiconductors, a special session on electronic devices and transport physics of wide bandgap semiconductors, and a nanotechnologies rump session with topics on transport, optical devices, carbon nanotubes, and molecular electronics.

In the class of III-V materials, many contributions addressed quantum dots (QDs) and their formation via overgrowth, multilayering, etc. Papers included those from Imperial College, UK (T.S. Jones), U. of Tokyo (Arakawa and Saito),

Technical University of Berlin (D. Bimberg), Virginia Commonwealth University-AFRL/ML (Huang, Morkoc, and Litton). A collaboration between Stanford, Cal Tech, and NTT reported on the spontaneous emission from a single QD – a good source of triggered single photons with implications for quantum computing. Problems associated with larger dots (as required for longer wavelength emission), remain poor size and distribution control.

In the novel class of magnetic materials and related spintronics, researchers use magnetic ions hosted in III-V crystals to exhibit spin-dependent phenomena. Several groups from Japan and Germany reported topics on spin transport in structures and spin injection (injection of spin polarized carriers), previously considered impossible. This shows that we are learning how to control and utilize the electron's spin degree-of-freedom in semiconductors. In Japan, Osaka and Tohoku Universities, ULVAC, NTT and JAIST reported on (i) structures, heterostructures, and spin injection, (ii) heterostructures based on the III-V alloy InMnAsSb/InSb for light-induced (2 ?m irradiation) ferromagnetism, and (iii) the growth of diluted magnetic semiconductor (DMS) GaN:Mn films by MBE with intrinsic ferromagnetism. Germany (Philipps U.) also reported on DMS -- the growth of GaMnAs by MOVPE. The Paul Drude Institute for Solid-State Electronics demonstrated the spin injection from a ferromagnetic metal into a semiconductor. Application areas of this class of materials include the spin-controlled field effect transmitter (spin-FET) and MRAM.

ISCS'01 was organized by the Institute of Industrial Science at the University of Tokyo and the Institute for Electronics, Information and Communication Engineers of Japan (IEICE) in conjunction with the Japan Society of Applied Physics and various IEEE Societies and chapters. (Maurice)

6th International Conference on Laser Ablation (COLA'01), 1-5 Oct 01, Tsukuba, Japan: COLA'01 met at the Tsukuba Epochal with over 200 participants and topics that spanned nanoscience and technology for which the laser and optical sources are implemented to control the chemistry and physics of critical processing reactions. Participants included 127 from Japan, 52 from Europe, 16 from the US, and 16 from elsewhere.

Laser ablation researchers that met at COLA'01 are developing advanced fabrication techniques that have a high degree of control and offer processing of a wide range of materials and also materials that specifically respond to laser or light-processing approaches. Topics included: laser surface interactions, mechanisms & diagnostics, modeling & simulation of laser-induced desorption and ablation, laser plasma and gas dynamic effects, matrix-assisted laser desorption ionization, pulsed laser film deposition, femtosecond applications, and biomedical ablation. For this 6th in its series, a special focus was on photochemistry. Brief highlights: laser-treating surfaces for processing/modification, functional structures with sub-micron resolution in photopolymerization resins using a two-photon absorption and ensuing chemical reactions, direct-write photopolymerization, mechanisms of energy transfer reactions using ultra-short pulsed lasers, and the creation of novel photo- and electro-functional materials via reactive intermediates. A special plenary on carbon nanotubes linked super-hard phases to

nanotechnology and ablation methods (NEC-Meijo University collaboration, Japan). Further program details are posted at the [COLA website \[31\]](#). COLA '01 was organized by K. Murakami *Univ. Tsukuba, Japan), A. Yabe (AIST, Japan), J. T. Dickinson (Washington State Univ), C. Fotokis (FORTH-IESL Univ, Greece), and J. S. Horowitz (Naval Research Lab) and was AOARD-supported. (Maurice)

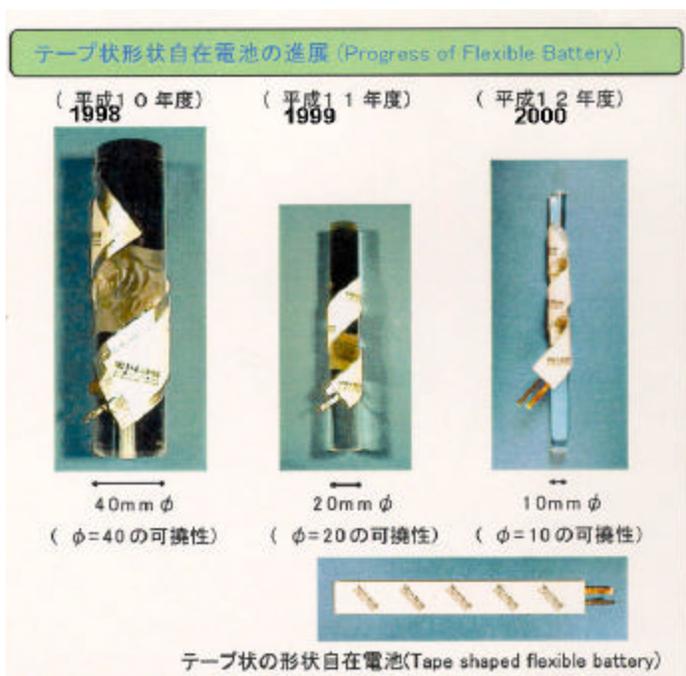
WOS Visits: 10th US-Japan Seminar on Dielectric and Piezoelectric Ceramics, Providence, RI, 27-29 September 2001: Sponsored under WOS, Drs. Masatoshi Adachi (Toyama Prefecture University), Tadashi Shiosaki (Nara Institute of Science and Technology), Noboru Ichinose and Yoshiaki Uesu (Waseda University) traveled to Rhode Island to participate in the seminar celebrating a 20-year history of joint US-Japan collaborations. They presented not only their own contributions but also those of numerous academic and industrial colleagues whose travel to the event was canceled.

Sessions included (1) Dielectrics, (2) Memory, (3) Piezoelectrics, and (4) Processing. The main focus of the seminar was on applications of Perovskite oxide materials based on Titanate, Niobate, Tantalate, and Zirconate, which possess many useful electronic properties such as spontaneous polarization, high dielectric constant, high electro-optic coefficient, and high piezoelectric constant. High dielectric constant is essential for achieving miniature capacitors, filters, and resonators for wireless communication. Japan seems to have a slight technical edge in this area, especially in multi-layered capacitor development. Dr. Adachi presented a paper on field-dependent dielectric properties that are crucial for applications in frequency-agile electronics and phased-array antennas. Spontaneous polarization in these materials has been explored for non-volatile Ferroelectric Random Access Memory (FeRAM), pushing the limit of pixel size from the current 0.5 micrometer to less than 0.1 micrometer. Dr. Shiosaki reported on the status of thin film research and development for FeRAM embedded memory systems in Japan. In the Piezoelectric Session, Dr. Ichinose presented his work on new Relaxor (lead-containing) compositions that promise relative ease of growing single crystals of good quality and sufficient size. Piezoelectric sensors and actuators are key components for smart systems and MEMS. Dr. Uesu gave a plenary lecture on the Second Harmonic Generation Interference Microscopy technique to analyze the three-dimensional domain structure. From the US side, DARPA and ONR-funded contractors dominated the meeting, but Dr. Bang-Hung Tsao of the University of Dayton Research Institute presented results of high-power capacitor research at AFRL's Propulsion Directorate. For additional information, contact Dr. Koto White (AFOSR/NI) at 703-696-7319. (White, Maurice)

Conference: 14th International Symposium on Superconductivity (ISS 2001), Kobe, Japan 25-27 September 2001. The latest installment of yearly international symposia on high-temperature superconductivity, sponsored by Japan's International Science and Technology Center (ISTEC), covered five main technical fields: physics and chemistry; wires and tapes and electrical systems; films, junctions, and electronic devices; bulk materials and systems applications; and vortex

physics. Nearly 400 papers were presented, with the majority coming from Japanese organizations. Plenary lectures included an update from Dr. Paul Grant of the Electric Power Research Institute on advances in U.S. superconductor power applications, talks by Dr. J. Akimitsu of Aoyama-Gakuin University and Dr. D. K. Finnemore of Iowa State University on recent developments with MgB₂ superconductors, a summary of mag-lev train development in Japan by Dr. A. Seki of the Central Japan Railway Co., and summaries of bulk materials and flywheel applications by Dr. X. Obradors of the University of Barcelona and Dr. N. Koshizuka of ISTEC. Presentations revealed substantial recent progress in basic science and technological development. The new superconductor MgB₂ has captured the attention of many, despite its rather low T_c of <40 K, because of absence of the weak-link problems that beset the cuprate superconductors and a potential for producing low-cost conductors. The tone of the conference was of measured enthusiasm. Discovery of new superconductors, advances in fundamental understanding, progress in component and device fabrication, and implementation of high-temperature superconductors into communications, electronics, and power applications provide a solid foundation for a bright future for superconductor science and technology. (Goretta)

Site Visit: Mitsubishi Materials Corporation, Tokai, Japan, 19 Sep 2001. As power supply is a primary subsystem of interest for microrobots, Mitsubishi Materials Corp. (MMC) was visited. MMC has developed a flexible microbattery (also known as a "tape battery") for micromachine application which can be wrapped around smooth objects in the same manner as duct tape. While this battery is rechargeable, unfortunately there are a number of characteristics which may limit employment for microrobots. First, a rechargeable battery does not hold a charge as long as a non-rechargeable or primary battery does. Secondly, a primary battery is not only more energetic, but is easier to miniaturize, thus accounting for its high utility in watches and cameras. Thirdly, while the MMC rechargeable battery has a higher discharge capacity (20mA) compared to the "button battery" (10mA), it has a limited cycle life. Normal rechargeable batteries can be recharged up to 500 times. However, the MMC battery can only be recharged up to 20 times. Finally, while primary batteries can maintain their charges for months, the MMC battery is only able to maintain its charge for at most 3-4 days. However, there are many other useful applications for this innovative design and MMC may continue to improve this design to overcome the above limitations. Considerable progress has been made over the last two years as shown below. (Sumrall)



Site Visit: Institute of Materials Research & Engineering (IMRE), National University of Singapore, Singapore, 6 July 2001: In conjunction with the recent MRS meeting in Singapore (ICMAT'01, see ASL 33), [IMRE \[32\]](#) was visited with several Nobel Laureates also touring its various Research Clusters and Labs. Broad-area focuses at IMRE are: molecular and bio materials science and characterization (including new in-situ systems that combine growth with observation/characterization), chemical systems, opto- & electronic systems, theory and modeling, and micro- and nanosystems. Established in 1996, the Institute seeks to partner with industry and international organizations towards development of advanced materials that can spawn new commercial products and/or transform technologies.

For example, a sampling of recent research in electronics includes silicides and sub-micron Si devices for CMOS and thin film technology, the growth of III-V materials for lighting, amorphous semiconductors, quantum dots, self-assembled and low-dimensional structures. Towards next-generation (sub-0.13 μ m) integrated CMOS devices, IMRE is reporting improvements of CoSi₂ and TiSi₂ processes and enhancement of NiSi for contact and interconnect materials. Metallic multilayered heterostructures on semiconductors are being developed for high-density magnetic storage heads (e.g., using Fe, Co, Cu, Cr). Also, there are projects on carbon doping by MOCVD for HBTs and InGaAsP and AlGaInP laser structures. New work on sensors for biomedical, chemical and environmental applications is particularly simple to use and easy to understand -- change-in-mass of the sensor is measured as specific chemical targets adsorb into the sensor surface. Of continuing interest at IMRE is the search for new polymeric materials with high strength-to-weight ratio, mainly for use in fiber-reinforced plastics. Also in polymers, IMRE is developing novel organic light-emitting display (OLED) materials and processes. This is for enhanced device reliability and manufacturability as well as new applications.

Organic/inorganic nano-composite materials are being developed with exceptional properties and may even supplant some traditional composites. In a collaboration with AFOSR through AOARD (POC: Dr. Charles Lee), exfoliated clay in the form of nano-platelets is blended with certain polymers to improve polymer toughness -- just one example of a large variety of new inorganic/organic hybrid materials with nano-scale. (Maurice)

Human Systems

Conference: 5th East Asian Conference on Chemical Sensors (EACCS '01), Huis Ten Bosch, Sasebo-shi, Nagasaki, Japan, 4-7 Dec 2001. The conference was held in conjunction with the 33rd Chemical Sensor Symposium of Japan Association of Chemical Sensors. More than 160 papers, contributed from 13 countries were presented in two parallel sessions. Session sections included Biosensors, Semiconductor Sensors, Micro Gas Sensors, Environmental monitoring, Solid Electrolyte Sensors, and Ion Sensors. A highlight of the conference was the invited paper, Biosensing with Thermally-Killed Microbial Cells. EACCS '01 was the 5th in a series: Fukuoka '93, Xi'an '95, Seoul '97 and Hsinchu '99. The next conference will be held in China. For more information on EACCS '01 refer to [their website \[33\]](#). (Brewer)

Conference: World Health Organization (WHO) Conference on Electromagnetic Fields (EMF) Biological Effects and Standards harmonization in Asia and Oceania, Seoul, Korea, 22-24 October 2001. The objective of this meeting, hosted by the Ministry of Information and Communication (MIC) of Korea, and WHO was to "overview biological and health effects of EMF exposure, and discuss possible health consequences from EMF from devices used in the Asian and Oceania Region (power lines, domestic and industrial electrical appliances, mobile telephones, radars and video display terminals). The meeting brought together approximately 150 international scientists and government officials to share research data and discuss the exposure policies of several countries. The World Health Organization was represented by Dr. Repacholi and Dr. Kheifets. One of the highlights of the meeting was that it attracted scientists and government officials from several countries (e.g., Indonesia, Malaysia, Mongolia, Nepal, Vietnam) that have not sent participants to previous bioelectromagnetics meeting or standards harmonization meetings. One of the primary concerns of these countries is whether to adopt the ICNIRP or IEEE standards. Dr. Patrick Mason of the Air Force Research Laboratory (AFRL/HEDR) gave an invited presentation titled "IEEE EMF Health & Safety Standards" and was co-authored by Michael R. Murphy and Ronald C. Petersen. (Mason, Park)

Site Visit: Communications Research Laboratory, Tokyo, 26 October 2001. Dr. Patrick Mason (AFRL/HEDR) visited Drs. So-Ichi Watanabe and Kanako Wake at the Communications Research Laboratory in Tokyo. They briefed him on the overall mission of the Laboratory and showed him

some of their exciting research. They designed the 1500 MHz exposure system that is being used in the 2-year rat brain tumor investigation at the Daiyu-Kai Institute of Medical Science. In the past, the research group at the Communication Research Laboratory has used in their research the rat dosimetry model developed at Brooks AFB. Currently, they are developing a rabbit dosimetry model to predict the energy absorption in the cornea during exposure to continuous or pulsed 2.45 GHz (3 kW peak, 45 W average) radiation. Cataract formation and corneal damage will be investigated in this experiment. This research group has also developed cartoon-like brochures for distribution to the general public describing electricity, microwave energy, the medical applications of electricity and microwave energy, and provides a simple explanation of the exposure standards.

(Mason)

Site Visit: Tokyo Metropolitan University, 25 October 2001.

Dr. Patrick Mason (AFRL/HEDR) visited the research laboratory of Dr. Masao Taki at Tokyo Metropolitan University. Dr. Taki is an international expert in acoustics and microwave dosimetry. Dr. Taki is also a member of the ICNIRP Commission and chairs the ICNIRP Standing Committee III (Physics and Engineering). During the visit, Dr. Mason experienced the effect of magnetophosphene development during exposure to an alternating magnetic field. With eyes open, a viewed image flickers at the frequency of the alternating magnetic field. During Dr. Taki's Window-on-Science visit to AFRL in 1999, he stated that magnetophosphenes can occur when the human head is exposed to an alternating magnetic field as low as 50 Gauss (5 mT) at 20 Hz. (Mason)

Conference: The 9th International Conference on the Conservation and Management of Lakes, Otsu, Shiga, Japan; 8-18 November 2001. This Conference has grown dramatically in size since the initial Conference in Shiga 17 years ago in 1984. The number of papers accepted is about 870 from 74 countries. It is the highest number in the 17-year history of this conference. This conference was extremely well supported by the United Nations Environment Programme, United Nations Development Programme, United Nations Educational, Scientific and Cultural Organization, The United Nations University, United Nations Center for Regional Development, Asian Development Bank, World Water Assessment Programme, Ministry of Economy, Trade and Industry, and many other Japanese Ministries, prefectural and city governments and a multitude of other supporters. Sessions included a special workshop on the Aral Sea where researchers from Uzbekistan and Kazakhstan will presented the latest reports based on their research. Shiga Prefecture near Kyoto has several organizations active in environmental research including the Research Center for Environmental Quality Control of Kyoto University and the [Lake Biwa Research Institute \[34\]](#). (Lyons)

Conference: Asia Display and International Display Workshop in Nagoya, Japan from 16-19 October 2001. From 13-25 October 2001 Dr Hopper traveled to Japan and Korea and attended this Society for [Information Display \(SID\)](#)

[Workshop \[35\]](#) to explore cooperative research in Asia on Advanced Display Technology. Dr. Hopper attended the quarterly Board of Directors meeting of the international Society for Information Display (SID) and was formally voted to become Chairman of the new SID Committee on Definitions and Standards. During the Nagoya Workshop, Dr. Hopper met with personnel from Australia, Japan, Taiwan, and the UK regarding advanced displays for cockpits, command centers, and wearable information systems. (Hopper, Lyons)

Conference: "Toward a Development of KANSEI Technology: Kansei 2001", Muroran, Hokkaido, Japan; 5-6 October 2001. This first Conference on [Kansei Engineering \[36\]](#), organized by the Satellite Venture Business Laboratory (SVBL), [Muroran Institute of Technology \[37\]](#), was attended by over 50 people from 6 nations. KANSEI is a Japanese word and implies human reaction under various stimuli ranging from sensory to mental state. The SVBL laboratory was established in 1998 with the research program to develop the basic technology for Life-Oriented Next Generation Software for application on the computer. This multi-disciplinary and international conference was attended by scientists from Japan, China, Korea, the U.S., Germany, Bulgaria, and Italy. Interesting presentations included face image processing to determine human mental state, physiologic measures of mental stress, computer design, physiologic effects of odor, quantification of non-verbal communication (eye movement), evoked potentials and attention, etc., (Lyons)

Site Visit: Kyushu Institute of Design, Department of Ergonomics, Fukuoka, Japan (Professor Yutaka Tochihara). The Research Center for Human Environmental Adaptation at Kyushu Institute of Design was completely reconstructed in 2001. The 7 environmental chambers have capabilities including exposure to hypo & hyperbaric, illumination, thermal, water immersion, and thermal radiation. The facility is capable of studying multiple stressors in addition to heat, cold, altitude such as isolation, variation in illumination, etc. The Center includes a living environmental chamber (sleeping facility) for long term exposure; simulation of a window and adjustable outside light was very interesting. Collaborating with Professor Tochihara is Professor Ohnaka of Fukuoka Women's University. The 10th International Conference on Environmental Ergonomics (ICEE 2002) will be organized by the Kyushu Institute of Design 23-27 September 2002. (Lyons)



Site Visit: Toyama Medical and Pharmaceutical University, Toyama, Japan (Professor Minoru Kasuya). Toyama Prefecture was the site of the world's first documented environmental cadmium poisoning. Mine slag polluted the Jinzu River resulting in osteomalacia (metabolic bone disease) in hundreds of local inhabitants. Research in the Department of Public Health has included cadmium toxicity, toxicity prediction, and eco-toxicology. Long term epidemiological studies have been undertaken at [Toyama Medical and Pharmaceutical University \[38\]](#) by Dr. Keiko Aoshima. (Lyons)

Site Visits: Trip to Singapore and Taiwan by major Todd Heinle to explore Possibilities for collaboration in Spatial Disorientation Countermeasures Program 8-17 September 2001. In Singapore Major Heinle (Manager, AFRL SD countermeasures program) visited The Defense Science and Technology Center (BG Lionel K.H. Lee, Director Defense Medical Research Institute) and the Aeromedical Center (Dr. Kenneth L. Fong, Chief, Aviation Medicine). Singapore Aeromedical Center facilities include a centrifuge, Vertifuge, and night vision training facilities.

In Taiwan, Major Heinle visited the Aviation Physiology Research Laboratory (Dr. Te Sheng Wen, Director), the Chung Shan Institute of Science and Technology (CSIST) (Dr. Chung-Hsing Gao, Director, Simulation Section), and the National Defense Medical Center (Dr. Yi-Chang Wu, Director, Institute of Aerospace Medicine). At CSIST facilities in Taichung, Taiwan has developed and constructed numerous training devices, including flight simulators, an ejection seat trainer, and a one of a kind SD training device. (Heinle, Lyons)

Site Visit: Radio Research Laboratory, Ministry of Information and Communication, Seoul (Dr. Jai-Rim Yuk, Director, Radio Environment Research Division). Approximately five years ago, a well-funded research program was initiated in Korea to determine the biological effects of electromagnetic field exposure and to address the issue of electromagnetic compatibility. While visiting the Radio Research Laboratory, Dr. Patrick Mason was an arrayed helical antennae that was developed for use on cellular telephones to reduce the amount of energy emitted by the telephone (Soo Wong Hong). The Finite-Difference Time-Domain (FDTD) code is being used to predict the location and amount of energy absorbed by the head during the use of this telephone. (Mason, Lyons)

Material Science

Conference: U.S. Air Force Specialist's International Workshop on Smart Composite Structures, Clayton, Australia, 22 November 2001. U.S.-sponsored Specialist's Workshops have been held immediately after every International Conference on Composites Structures. This year's workshop was conceived and organized by Dr. Thomas Kim of AFOSR and Dr. Ian Marshall of Monash University. The selected topic is of keen interest to many, and the state of current technology has advanced to where smart structures can

be envisaged in many aerospace applications. Such structures offer promise of optimal design, enhanced reliability, and economic performance. The workshop featured talks and discussion from participants from a half dozen countries on subjects such as in-situ health monitoring, properties of composites that contain piezoelectric members, shape control through incorporation of smart materials, and complex design protocols. (Goretta)

Conference: 11th International Conference on Composite Structures (ICCS-11), Clayton, Australia, 18-21 November 2001. The Conferences on Composite Structures have been organized by Dr. Ian Marshall and held every two years since 1981. The 2001 conference featured sessions on design, processing, testing, modeling, failure, and repair of composite structures, and topics such as joining, water-jet cutting, vibrations, and aerospace structures. Plenary lectures were provided by Dr. Ian Mair on the programs of the Australian Co-operative Research Center on Advanced Composite Structures and Dr. Don Dawe on use of finite strips in modeling buckling of composite structures. Most of the talks concentrated on polymeric composite structures, but papers were also presented on metal- and ceramic-matrix composites. Despite their complexity, the mechanical properties of composite structures can be modeled effectively by a variety of finite-element methods. These methods tend, however, to be computationally intensive, and efforts are in progress to determine ways by which computation times can be shortened. (Goretta)

Site Visit: Department of Mechanical Engineering, Monash University, Clayton, Australia, 16 November 2001. Professors in the Mechanical Engineering Department of Monash University (MU) are studying a broad range of materials-engineering problems. Particular strengths include modeling of mechanical properties, health monitoring, nondestructive examination, impact testing, and complex-stress testing. Materials programs are slated to receive additional emphasis when MU completes construction of a planned A\$157 million synchrotron. MU, which is one of the eight leading research universities in Australia, has more than 47,000 students and staff distributed among six campuses in Australia, and campuses in Malaysia and South Africa. In addition to conventional engineering degrees, MU now graduates students with majors in Interdisciplinary Engineering, Mechatronics Engineering, and Software Engineering. (Goretta)

Site Visit: Materials Science Programs, University of Melbourne, Melbourne, Australia, 15 November 2001. Materials science and engineering work takes place within the Mechanical and Chemical Engineering Departments of the University of Melbourne (UM). Areas of study include geopolymers, biomaterials, composite manufacture and characterization, and fracture and fatigue. Other work of substantial interest to the Air Force, such as wind-tunnel testing, manufacturing research, and fluid-dynamics studies is also found within these departments. The UM is one of eight leading research universities in Australia. Of its enrollment of 36,000, approximately 4400 are within the Faculty of Engineering. (Goretta)

Conference: The 7th Japan International SAMPE Symposium, Tokyo Japan, 13-16 Nov 2001: As with previous conferences in this biennial series, the symposium provided a venue for Japanese and foreign academia and industry to come together to present developments in the areas of advanced materials and processing. The focus was mostly on composite material structures. 15 workshops and sessions plus several special lecture sessions were included.

NEDO's R&D Program on Revolutionary Low-Cost and Lightweight Aircraft provided an opportunity to look into progress in this 5-year Japanese project which started in 1999. It is trying to capitalize on the increasing composite fabrication work that Japanese companies are doing, not only for indigenous air, land, and sea vehicles but also for foreign firms such as Boeing.

Concurrent with the Symposium was an exposition by corporations and research firms. (Nowack)

Conference: 5th International Conference on Durability Analysis of Composite Systems (DURACOSYS 2001), Tokyo University of Science, 6-9 Nov 2001. This latest in a biennial series of conferences was a forum for composite durability research. A number of papers related to air vehicle issues were presented, including an adhesive joint NDE presentation "Dielectric spectroscopy technique to assess the durability of adhesively bonded composite joint structures" by Prof. Wm Banks (Univ of Strathclyde), an EOARD-supported researcher. Presentations represented work in eighteen countries. A paper list can be viewed at this [website \[39\]](#). DURACOSYS was supported by AOARD as well as the ONR-IFO and ARO. DURACOSYS 2003 will be held in San Diego. (Nowack)

Site Visit: Myongji University, Yong-in Campus, Kyunggido, S. Korea, 12 October 2001. A private university, Myongji has campuses in Seoul and Kyunggido. Science and engineering are centered at the latter. Research departments and divisions include the natural and physical sciences, Electrical and Information Control Engineering, Electronics and Information and Communications Engineering, and the following Engineering Departments: Ceramic, Chemical, Mechanical, Industrial, Civil and Environmental, Transportation, and Computer. Studies are divided among emerging and traditional technologies. (Goretta, Park).

Site Visit: Hanyang University, Department of Metallurgy and Materials Science, Ansan, S. Korea, 11 October 2001. Hanyang University has large campuses in Seoul and Ansan. The College of Engineering is in Ansan. Materials research at Hanyang is conducted primarily in the Department of Metallurgy and Materials Science and the Division of Materials and Chemical Engineering. Our visit focused primarily on the laboratory of Prof. D. H. Shin, who studies deformation processing, mechanical properties, and microstructure of metals and alloys. Prof. Shin and his department possess well-equipped laboratories for materials processing and characterization. Collaboration within the department and with other universities and research organizations is strongly encouraged. (Goretta, Park).

Site Visit: Chungnam National University, Department of Metallurgical Engineering, Taejon, S. Korea, 10 October 2001. There are 12 faculty members in the Metallurgical Engineering department at Chungnam National University. Their research efforts focus on ferrous and nonferrous metals, materials processing, and study of microstructure and properties. The department's emphasis is on bulk materials, but there is also a significant effort in thin films. We visited the laboratory of Prof. S. I. Hong. His work with advanced alloys and bulk metallic glasses was discussed in detail. (Goretta, Park)

Site Visit: Korea Advanced Institute of Science and Technology, Department of Materials Science and Engineering, Taejon, S. Korea, 9 October 2001. The Korea Advanced Institute of Science and Technology (KAIST) is the only major university in Korea that is administered by the Department of Science and Technology rather than the Department of Education. This unique status has helped to ensure strong federal support for KAIST and its mission. KAIST was founded 30 years ago as a graduate school, and still today focuses on graduate education. The Materials Science and Engineering Department consists of 29 professors, more than 300 graduate students, and nearly 100 undergraduate students. Two-thirds of the faculty members received their doctorates from U.S. universities, and one-quarter received them from European or Japanese universities. This large and diverse department conducts research across a broad spectrum of disciplines and features three research centers: the Center for Interface Science and Engineering of Materials, the Electronic Ceramic Materials Research Center, and the Electronic Components Materials Design Education Center. In addition, as part of Korea's Brain Korea 21 Program, the Department is home to the Center for Frontier Materials. In contrast to the other large materials programs in Korean universities, KAIST's emphasis is rather strongly on electronic and optical materials. Superconductors are also being studied, although the majority of that work is conducted in the Physics Department. (Goretta, Park)

Site Visits: Pohang University of Science and Technology (Postech), Department of Materials Science and Engineering, Pohang, S. Korea, 8 October 2001. Postech was founded in 1986, with strong financial support provided by an endowment from the Pohang Iron and Steel Company (POSCO). The close ties between Postech and POSCO have ensured that materials research receives strong and sustained funding. The Department's 21 professors (80% of whom received doctorates from the U.S.) and approximately 150 graduate students and 110 undergraduate students focus on five main research thrusts: electronic materials for information technology, materials for energy and environmental technologies, advanced structural materials, biomaterials, and clean and green ferrous technologies. In addition to research within these broad topics, the Department is affiliated with Postech's Center for Advanced Aerospace Materials, the Technology Innovation Center for Metals and Materials, the Polymer Research Institute, and the Graduate School of Iron and Steel Technology. The Korean Ministry of Science has appointed three laboratories at Postech that are of direct support

to the Department's research activities. These laboratories are the National Research Laboratory for Ferroelectric Phase Transformations, the Compound Semiconductor Process Laboratory, and the Synchrotron Xray Laboratory, which is part of the Pohang Accelerator Laboratory (PAL). PAL, which was commissioned in 1994, is one of the eight second-generation synchrotron light sources in the world. Its operating voltage of 2.5 GeV places it mid-range among the eight and offers access to a wide range of materials science and biological studies. PAL has 25 beam lines now in use or under construction and has room available for nearly double that amount when they become required. (Goretta, Park)

Site Visit: Seoul National University, School of Materials Science and Engineering, Seoul, S. Korea, 5 October 2001.

The materials science and engineering program at Seoul National University (SNU) is one of the strongest among the world's universities. It has a sisterhood relationship with the Department of Materials Science and Engineering at the University of Illinois in Urbana-Champaign. SNU's School comprises 36 faculty member, nearly 350 graduate students, and 750 undergraduate students. Two-thirds of the faculty members received their doctorates from U.S. universities, and one-sixth received them from European universities. Research, which is supported primarily by national funds, is focused in four broad areas: metallurgy, ceramics, electronic materials, and polymers. Faculty members contribute to a multitude of national research centers located at SNU, including the Hyperstructured Organic Materials Research Center, the Center for Microstructure Science of Materials, the Research Institute of Advanced Materials, the Microsystem Technology Center, the Nano Bioelectronics and Systems Research Center, and the Inter-University Semiconductor Research Center (ISRC). The ISRC is especially noteworthy. Part of its mission is to foster collaborations with industry and to assist small companies in their development. Facilities for characterization of semiconductors are made available, free of charge, to all qualified applicants, including those from foreign countries. (Goretta, Park)

Window-on-Science Visit: Prof. Hiroshi Fukuda, Science University of Tokyo, Chiba, Japan, 9-12 September 2001.

Prof. Fukuda attended the 16th Annual Technical Conference of the American Society for Composites in Blacksburg, VA. He presented a paper entitled "Compression Bending Test Method for CFRP Pipe." It is recognized that in conventional testing the measured bending strengths of polymer-matrix composite pipes are strongly affected by stress concentrations induced by the loading device. Prof. Fukuda and his colleagues have devised an alternative test method based on Euler buckling of a column. They have successfully applied the method to thin-walled pipes. Both bending strength and bending modulus can be calculated from data for applied load and crosshead displacement. In addition, an eccentric bending test has been developed, in which a compressive load can be combined with a bending moment. This type of test requires more complex fixtures, but is well suited to testing of large-diameter pipes. Prof. Fukuda is an organizer of the 5th International Conference on Durability Analysis of Composite Systems, held in Tokyo on 6-9

November 2001. While in Blacksburg, he met with several key participants in that conference, which helped to finalize its planning. (Goretta)

Window-on-Science Visit: Prof. O-II Byon, College of Industrial Technology, Nihon University, Chiba, Japan, 9-12 September 2001.

Prof. Byon presented a paper on fabrication of shape-memory-alloy fiber composites and hybrid composites and their mechanical properties at the 16th Annual Technical Conference of the American Society for Composites, Blacksburg, VA. The motivation for this work was to demonstrate the feasibility of using the known shape change of a shape-memory alloy (SMA) to control vibrations in composites by changing temperature. A series of epoxy-matrix composites in which SMA fibers and, in some cases, graphite fibers were embedded has been fabricated. Basic mechanical properties have been measured at 25-75°C, which includes the temperature at which shape changes occur. Vibration suppression was also examined as a function of temperature. Results have provided clear evidence of the utility of this method for active control of vibration in air and space vehicles. During his visit to the U.S., Dr. Byon also had discussions with Drs. Charles F. Lee and Thomas Kim of AFOSR. (Goretta)

Window-on-Science Visit: Prof. Takashi Yamamoto, Faculty of Science, Yamaguchi University, Yamaguchi, Japan, 31 August 2001.

Prof. Yamamoto visited the AFRL/ML Directorate at Wright-Patterson Air Force Base (WPAFB), where he presented a seminar on crystallization of polymers and oligomers and met with Dr. Barry Farmer and several staff members. Prof. Yamamoto's work has demonstrated the efficacy of molecular-dynamics simulations in study of surface crystallization. Chain-end effects have been shown to be especially important to the ordering processes. Discussions with the WPAFB staff focused on application of computer simulations to several classes of polymer systems, including POSS nanocomposites, new nanomaterials, various functional polymers, and biologically based polymers. Prof. Yamamoto believes that complex structure formation in nanoscopically confined systems and their corresponding materials properties, various biological systems, and search for and development of bio-inspired systems offer fertile ground for new modeling work. Prior to visiting WPAFB, Prof. Yamamoto presented a paper on his work at the American Chemical Society Symposium in Chicago, IL. (Goretta)

WOS Visit: Prof. Ikai Lo, National Sun Yat-Sen University (NSYSU), Taiwan, July-August 2001.

This summer Prof. Ikai Lo joined GaN researchers at MLPS for topics in growth mechanisms, electronic properties, and optical behavior of MBE-grown epilayers. He presented work on GaN-based heterostructures and the status of GaN growth projects in Taiwan. Prof. Lo is Physics Dept. Chairman at NSYSU and heads-up GaN efforts there, the focus of which is on materials for optical devices. The NSYSU group under Prof. Lo studies the effects of quantum confinement within the quantum well structures required for optical devices, such as the 2-dimensional electron gas formed at material interfaces, and their role in governing the electronic and subsequent optical material

properties and performance of laser diodes. The group recently set-up a molecular beam epitaxy (MBE) laboratory to grow GaN structures. Though most group III-nitrides are grown by metal organic chemical vapor deposition (MOCVD), MBE can result in high-purity material and provide better control of the interfaces than MOCVD -- important, for example, for improved p-doping.

In addition to augmenting MLPS's MBE effort, during his visit, Dr. Lo also demonstrated measurement of the Shubnikov-de Haas (SdH) effect on a 2-subband-populated MOCVD-grown GaN HEMT structure. This SdH measurement indicated that the two lowest subbands were populated with carrier concentrations $1.244 \times 10^{13} \text{ cm}^{-3}$ and $1.476 \times 10^{13} \text{ cm}^{-3}$ and that the carrier quantum lifetime was greater in the 2nd subband. POC: Dr. Bill Mitchel, AFRL/MLPS. (Maurice)

Micro Systems

Conference: 2001 International Symposium on Micromechanics and Human Science, Nagoya, Japan, 10-11 Sep 2001: In spite of being interrupted by a typhoon, the symposium, the 12th annual in Nagoya covering micromechanisms, proved to be a good forum to present results from various research groups in the South of Japan as well as abroad. This is a good location since Nagoya University has been active in the national micro-machine project and Nagoya City has been supporting human science through the creation of the Shidami Human Science Park. In the plenary sessions, Sony reviewed the development of the SDM-3X bipedal dancing entertainment robot. Ritsumeikan University, with a strong fabrication program built around its synchrotron radiation source was well represented. The Ritsumeikan micro-machined thermal pile generated a lot of audience interest.

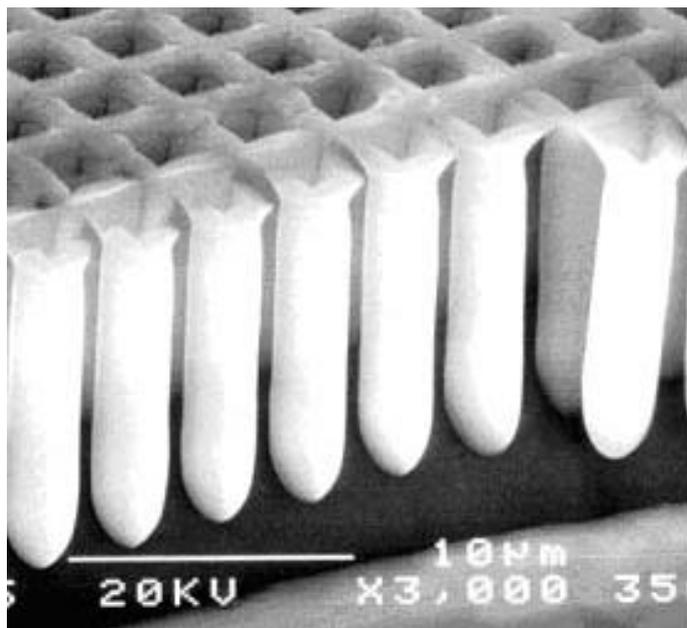
The human-biology theme was well represented by many papers on bio-micromanipulation on individual cells. Both contact and noncontact methods such as electromanipulation were presented along with improvements in cell visualization.

Olympus presented the latest work on their medical and industrial catheters. One developed for machinery repair boasts a 3mm dia, 10mm long YAG laser welding system in the tip. Key to Olympus miniaturization efforts is mounting functional devices on a flexible 10 μm polyimide film which can be folded to achieve novel component arrangements.

Prof Mohri of Nagoya University provided an update on sensors built around amorphous wire technology. His magnetic flux sensor boasts a 0.1 μGauss sensitivity, but packaged into 1mmx2mm. In addition to the obvious use for electronic compasses, it is finding great interest among brain surgeons since the magnetic flux from cancerous tumors differs from the rest of the brain. Since tumors are difficult to identify visually, the small flux sensor provides a means of pinpointing a tumor's extent.

The symposium was held along with the International Micro Robot Joint Contest, an annual event that is fueling the creativity of the next generation of micro-roboticists. (Nowack)

Site Visit: Mitsubishi Electric Corporation, Amagasaki, Hyogo, Japan, 26 July 2001. A porous silicon electrochemical wet etching process has been developed. This process is able in one process step to form three-dimensional porous silicon structures. In the picture below the three dimensional "micro-test tubes" display the fabrication method's potential. The high aspect ratio structures (over 60) are over 300 micrometers tall and created with nanometer precision. The process called single-step electrochemical etching for microstructures (SEEMS) is based on changing the intensity of light on the structure etched. Increasing the light intensity increases hole size of the porous silicon during wet etching with HF. Devices under development with Deft University of Technology in Germany include DNA sequencing devices and accelerometers. (Pokines)



Site Visit: New Industry Creation Hatchery Center-Microsystems Laboratory, Tohoku University, Sendai, Japan, July 2001. Dr. Masayoshi Esashi at Tohoku University heads one of the most active microsystems laboratories in the world with over 100 researchers. Dozens of projects such as DNA analysis chips, micro ultrasonic probes, micro fuel cells, digital micro-thrusters, ultra sensitive accelerometers, RF switches, and micro-cooling systems are ongoing. Key project efforts are related to the development of micro-power sources (with over \$5 million committed from government sponsors for an evaluation study over the next 3 years) such as micro gas turbines, shape memory alloy driven active catheters, data storage, and Si bulk micromaching efforts. The laboratory's fabrication processes are based on 2" Si wafers to minimize development time. Fabrication specialization techniques include deep reactive ion etching methods and precision milling. A unique characteristic of the laboratory is the mix of international students, industry researchers, and academic researchers working in the laboratory. The laboratory has seen rapid growth in the last 3 years with the construction of new facilities,

acquisition of new equipment, and a doubling of the research members. Work continues round-the-clock in this premier laboratory. (Pokines)

Conference: International MEMS (iMEMS) Workshop 2001, Singapore, 3-6 July 2001. iMEMS was supported by AOARD and attended by over 150 researchers from around the world. One focus of the workshop was education through a series of tutorials covering micro-fluidics, comb drives, RF MEMS, and life science topics related to micro- & nano-technology. A broad range of topics was covered in the technical sessions of the workshop including commercialization, Bio MEMS, actuators, packaging, and RF MEMS. Presenters

from Singapore outnumbered other country participants. This was a result of the location and although support and sophistication of microsystem research lags behind Japan and Korea, Singapore has a strong commitment to the technology including a plan by the National Science and Technology Board to develop a strong commercial presence in this technology area. MEMS and nano-technology are identified as core focus areas by government laboratories such as the Institute of Materials Research & Engineering (e.g. polymer MEMS), Gintic (e.g. MEMS packaging) and the Institute of Microelectronics (e.g. Si based MEMS) and are supported by graduate programs in MEMS at the National University of Singapore and Nanyang Technological University. (Pokines)

Further Information

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Upcoming Conferences In Asia

These upcoming conferences may be of interest to you. Contact us for more details or check our homepage at <http://www.nmjc.org/aoard/> Conferences in **BoldFace** are AFOSR/AOARD Supported.

Date	Name	Place
Jan 28-Feb 1, 02	International Symposium on Applications and the Internet	Nara, Japan
Jan 28-Feb 1, 02	Australasian Computer Science Conference (ACSC2002)	Melbourne, Australia
Jan 29-31, 02	The 2nd International Display Manufacturing Conference & Exhibition (IDMC 2002)	Seoul, South Korea
Jan 29-31, 02	Delta 2002, International Workshop on Electronic Design, Test, & Application	Christchurch, New Zealand
Jan 31-Feb 1, 02	8 th Symposium on Microjoining and Assembly Technology in Electronics (Mate 2002)	Osaka, Japan
31 Jan-2 Feb, 02	Third Asian-Australian Conference on Composite Materials (ACCM-3)	Auckland, New Zealand

Date	Name	Place
Feb 1-2, 02	International Conference on Advances in Materials and Materials Processing (ICAMMP-2002)	Kharagpur, India
Feb 4-5, 02	The Sixth International Conference on Flow Processes in Composite Materials (FPCM-6)	Auckland, New Zealand
Feb 5-8, 02	Workshop on Preliminary Design of Composite Structural Joints	Canberra, Australia
Feb 6-7, 02	Internet Workshop 11	Tokyo, Japan
Feb 6-8, 02	The International Conference on Bioinformatics 2002: North-South Networking	Bangkok, Thailand
Feb 12-15, 02	Autonomous Intelligent Systems ICAIS 2002	Geelong, Australia
Feb 13-16, 02	2 nd IUPAC Workshop on Advanced Materials (WAM II): Nanostructured Advanced Materials	Bangalore, India
Feb 20-22, 02	Third Australasian Congress on Applied Mechanics	Sydney, Australia
Feb 22-23, 02	Frontiers in Materials Science and Technology	India
Feb 26-28, 02	Digital Media World Australia 2002	Sydney, Australia
Mar 3-8, 02	International Conference on Physics at Surfaces and Interfaces (PSI 2002)	Puri, India
Mar 4-6, 02	International Symposium on Mesoscopic Superconductivity and Spintronics (MS+S2002)	Kanagawa, Tokyo
Mar 5-8, 02	The 17 th International Colloquium on Magnetic Films and Surfaces	Kyoto, Japan
Mar 6-8, 02	International Nanotechnology Exhibition/Conference	Chiba Prefecture, Japan
Mar 12-14, 02	“International Symposium on Quantum Computing” Nano-Science & Technology for Implementation of Quantum Computers	Tokyo, Japan
Mar 13-15, 02	5th Asia Pacific Chitin-Chitosan Symposium (5th APCCS)	Bangkok, Thailand
Mar 18-20, 02	International Conference on Algebra and Its Applications	Bangkok, Thailand
Mar 20-22, 02	Customer Contact World	Singapore
Mar 24-26, 02	Annual Meeting of the Ceramic Society of Japan	Osaka, Japan
Mar 24-29, 02	Bulk Metallic Glasses (Bulk Amorphous Alloys) II	Keelung, Taiwan
Apr 3-5, 02	Mathematical Morphology & its Applications to Image and Signal Processing	Sydney, Australia
Apr 3-5, 02	Ninth International Conference on Computing in Civil and Building Engineering (ICCCBE-IX)	Taipei, Taiwan
Apr 4-5, 02	Asian Workshop on Polymer Processing in Singapore 2002	Singapore
Apr 7-10, 02	FOCUS ON MICROSCOPY 2002 15th International Conference on 3D Image Processing in Microscopy 14th International Conference on Confocal Microscopy	Kaohsiung, Taiwan
Apr 18-20, 02	COOL Chips V – An International Symposium on Low-Power and High-Speed Chips	Tokyo, Japan
Apr 21-24, 02	The Beginnings of the Use of Metals and Alloys (BUMA V)	Kyongju, Korea
Apr 21-26, 02	USARPAC Asia-Pacific Military Medicine Conference	Kuala Lumpur, Malaysia
Apr 22-24, 02	10 th Symposium of Interfacial Material Science on Composites (SIMS-CX)	Tokyo, Japan
Apr 23-24, 02	Symposium on Photomask and NGL Mask technology IX (Photomask Japan 2002)	Yokohama, Japan
May 9-11, 02	5th Symp. on Natural Language Processing + Oriental COCODA Workshop	Hua Hin, Thailand
May 12-17, 02	2002 IEEE World Congress on Computational Intelligence	Honolulu, HI
May 12-17, 02	CEC 2002, Congress on Evolutionary Computation	Honolulu, HI
May 12-17, 02	IJCNN 2002, Intl Joint Conf. on Neural Networks	Honolulu, HI
May 12-17, 02	FUZZ-IEEE 2002, Intl Conf. on Fuzzy Systems	Honolulu, HI
May 13-15, 02	The 35th CIRP International Seminar on Manufacturing Systems (CIRP-ISMS 2002)	Seoul, Korea
May 14-16, 02	The 16 th International Workshop on Communications Quality & Reliability (CQR2002)	Okinawa, Japan
May 15-17, 02	The Seventh World Congress on Biosensors	Kyoto, Japan
May 15-17, 02	The 1 st International Symposium on Energetic Materials and their Applications (ISEM2002)	Tokyo, Japan
May 16-18, 02	2002 International CIRP Design Seminar	Hong Kong
May 20-22, 02	ALTA 2002 Nickel/Cobalt-8	Perth, Western Australia
May 23-24, 02	ALTA 2002 Copper-7	Perth, Western Australia
May 22-24, 02	The First International Conference on Advanced Structural Steels (ICASS 2002)	Tsukuba, Japan
May 22-24, 02	International Conference Computational Mathematics and Modeling (CMM2002)	Bangkok, Thailand
May 26-Jun 2, 02	23 rd International Symposium on Space Technology and Science	Matsue, Japan
May 27-31, 02	International Congress on Laser Advanced Materials Processing (LAMP 2002)	Osaka, Japan

Date	Name	Place
May 27-31, 02	The 15 th International Conference on Plasma Surface Interactions in Controlled Fusion Devices (PSI-15)	Gifu, Japan
May 28-Jun 1, 02	International Joint Conference on the applications of Ferroelectrics 2002	Nara, Japan
May 29-31, 02	IFIP WG9.4 Conference on ICTs & Development: New Opportunities, Perspectives, & Challenges	Bangalore, India
Jun 5-8, 02	Mechanics & Materials in Design 4 th International Conference	Nagoya, Japan
Jun 10-14, 02	The 4 th World Congress on Intelligent Control and Automation (WCICA'02)	Shanghai, China
Jun 17-18, 02	International Conference on Artificial Intelligence in Engineering and Technology	Kota Kinabalu, Malaysia
Jun 23-27, 02	Defense Applications for Signal Processing (DASP2001)	Adelaide, Australia
Jun 25-27, 02	International Symposium on Distributed Autonomous Robotic Systems	Fukuoka, Japan
Jun 26-28, 02	The 1 st Asian Conference on Photobiology	Hyogo, Japan
30 Jun-5 Jul, 02	Second International Conference on Porphyrins and Pthalocyanines (ICPP-2)	Kyoto, Japan
Jul, 02	Topical Workshop in Heterostructure Materials (TWHM'02)	Japan
Jul 1-5, 02	The 9 th International Symposium on the Genetics of Industrial Microorganisms (GIM-2002)	Korea
Jul 7-12, 02	IUPAC World Polymer Congress 2002-39 th International Symposium on Macromolecules	Beijing, China
Jul 8-12, 02	The 2 nd International Conference on Computational Fluid Dynamics	Sydney, Australia
Jul 8-12, 02	7 th OptoElectronics and Communications Conference (ECC2002)	Yokohama, Japan
Jul 8-13, 02	US-Korea Conference on Science, Technology, and Entrepreneurship2002 (UKC-2002)	Seoul, Korea
Jul 9-12, 02	2002 Western Pacific Geophysics Meeting	Wellington, New Zealand
Jul 10-12, 02	The 9 th International Workshop on Active-Matrix Liquid-Crystal Displays	Tokyo, Japan
Jul 10-12, 02	Geometric Modeling and Processing 2002 (GMP2002)	Saitama, Japan
Jul 14-18, 02	The Fourth International Conference on Matrix Analytic Methods in Stochastic Models	Adelaide, Australia
Jul 14-19, 02	14 th International Conference on Organic Synthesis (ICOS-14)	Christchurch, New Zealand
Jul 15-17, 02	2002 Japan-USA Symposium on Flexible Automation	Hiroshima, Japan
Jul 15-19, 02	The International Congress on Plasma Physics, ICPP 2002	Sydney, Australia
Jul 17-19, 02	International Conference on Smart Materials, Structures, and Systems	Bangalore, India
Jul 21-26, 02	Eighth International Conference on the New Diamond Science and Technology (ICNDST-8)	Melbourne, Australia
Jul 21-26, 02	World Congress on Particle Technology 4	Sydney, Australia
Jul 22-24, 02	Pacific Rim Workshop on Transducers and Micro/Nano Technologies	Xiamen, China
Jul 22-24, 02	2nd Asian Conference on Vision (ACV 2002)	Gyeongju, Korea
Jul 22-25, 02	World Space Environment Forum (WSEF 2002)	Adelaide, Australia
Jul 22-26, 02	7 th International Conference on the Structure of Surfaces	New Castle, Australia
Aug 5-15, 02	New Directions in Dynamical Systems 2002 (ICM 2002 Satellite Conference)	Kyoto, Japan
Aug 16-18, 02	Symposium on Stochastics and Applications (SSA)-An ICM-2002 Satellite Conference	Singapore
Aug 18-22, 02	AusBiotech 2002, National Conference	Melbourne, Australia
Aug 18-22, 02	Seventh Pacific Rim International Conference on Artificial Intelligence	Tokyo, Japan
Aug 20-27, 02	The 23 rd International Conference on Low Temperature Physics	Hiroshima, Japan
Aug 20-28, 02	ICM-2002 & Satellite Conferences for ICM 2002	Beijing, China
Aug 21-23, 02	The Second International Conference on Advances in Structural Engineering and Mechanics (ASEM'02)	Pusan, South Korea
Aug 24-27, 02	International Conference on Experimental and Computational Mechanics in Engineering	Dunhuang, China
Aug 27-28, 02	Asia Pacific Magnetic Recording Conference 2002	Singapore
Sep 3-6, 02	The IEEE 5th International Conference on Intelligent Transport Systems	Singapore
Sep 8-13, 02	8 th International Conference on Quasicrystals (ICQ8)	Bangalore, India
Sep 16-18, 02	The 10 th Japan-U.S. Conference on Composite Materials	California, USA
Sep 18-20, 02	11 th International Plastic Optical Fibers Conference 2002	Tokyo, Japan
Sep 23-27, 02	The 10th International Conference on Environmental Ergonomics (ICEE 2002)	Fukuoka, Japan

Date	Name	Place
Sep 25-27, 02	Minerals Engineering 2002	Perth, Australia
Sep 25-27, 02	The 4th Asian Control Conference	Singapore
Sep 29-Oct 3, 02	6 th International Conference on Mechatronics Technology	Kitakyushu, Japan
Oct 15-18, 02	The 10 th JSME Materials and Processing Conference (M&P 2002)	Honolulu, Hawaii
Oct 20-23, 02	2002 International Symposium on Micromechanics and Human Science	Nagoya, Japan
Oct 21-23, 02	Asian Symposium on Biomedical Optics and Photomedicine	Sapporo, Japan
Oct 21-24, 02	AsiaTrib 2002 International Conference	Cheju, South Korea
Oct 21-25, 02	The 4 th International Symposium on Control of Semiconductor Interfaces (ISCSI-4)	Karuizawa, Japan
Oct 29-31, 02	Small Engine Technology Conference (SETC)	Kyoto, Japan
Oct 29-31, 02	WHO, EMF Biological Effects and Standards Harmonization Meeting	China
Oct 27-Nov 1, 02	The Seventh International Conference on Technology of Plasticity	Yokohama, Japan
Oct 30-Nov 1, 02	3 rd International Conference on Optics-photonics Design & Fabrication (ODF2002)	Tokyo, Japan
Nov 4-7, 02	Pacific Rim Radio Frequency Radiation Conference	Phuket, Thailand
Nov 5-8, 02	International Topical Meeting on Microwave Photonics (MWP2002)	Hyogo, Japan
Nov 11-13, 02	Heli Japan 2002 AHS International Meeting on Advanced Rotorcraft Technology and Life Saving Activities	Utsunomiya, Japan
Nov 12-15, 02	International Symposium on Alcohol Fuels (ISAF XIV)	Phuket, Thailand
Nov 17-20, 02	The 8 th Pacific Rim Biotechnology Conference	Auckland, New Zealand
Nov 18-22, 02	9th International Conference on Neural Information Processing (ICONIP02)	Singapore
Nov 18-22, 02	4th Asia-Pacific Conference on Simulated Evolution and Learning	Singapore
Nov 18-22, 02	International Conference on Fuzzy Systems and Knowledge Discovery	Singapore
Nov 27-29, 02	Seventh International Conference on Manufacturing	Bangkok, Thailand
Dec 2-5, 02	IUPAC Polymer Conference on the Mission and Challenges of Polymer Science and Technology (IUPAC-PC2002)	Kyoto, Japan
Dec 2-6, 02	The Sixth Asia-Pacific Symposium on Engineering Plasticity and its Applications	Sydney, Australia
Dec 2-6, 02	The 15th Australian Joint Conference on Artificial Intelligence (AI'02)	Canberra, Australia
Dec 5-6, 02	Future of Artificial Intelligence	Maebashi, Japan
Dec 9-12, 02	IEEE International Conference on Data Mining (IEEE ICDM-2002)	Maebashi, Japan
Dec 15-18, 02	Intelligent Systems and Applications ISA 2002	Shanghai, China
Jan 13-15, 03	1st International Symposium on Information Technology in Engineering	Sydney, Australia
Apr 6-10, 03	International Conference on Acoustics, Speech and Signal Processing (ICASSP)	Hong Kong, China
May 19-22, 03	SAE "Spring" Fuels & Lubricants Meeting	Yokohama, Japan
May 19-23, 03	The 4th International Conference on Intelligent Processing and Manufacturing of Materials (IPMM'03)	Sendai, Japan
May 28-30, 03	Third International Conference on Fatigue of Composites (ICFC 3)	Kyoto, Japan
Jun 25-27, 03	Third International Symposium on Turbulence and Shear Flow Phenomena	Sendai, Japan
Jul 7-11, 03	5 th International Congress on Industrial and Applied Mathematics	Sydney, Australia

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